University students' interactions using scaffolds in two different virtual forums

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Abstract
This research is based on collaborative learning processes using scaffolds. Specifically, we aim to ascertain whether there are any significant differences in students' results after following the same learning instructions for participating in a virtual forum in two different subjects. We also aim to analyse the mediator's role, the use of scaffolds, and if students have followed real metacognitive processes. A total of 104 university students were involved. The main findings of our study emphasize the importance of well-designed learning instructions for participating in a virtual forum, which could be applied to any subject. Moreover, students are more active in their learning process and collaborative communication if the lecturer plays an active role overseeing students' participation and guiding the construction of knowledge.

Keywords: virtual forums, interactions, graphs, higher education, CSCL, scaffolds, learning instructions, mediator's role.

1 Introduction

Nowadays, Information and Communications Technologies (ICT) are used in the teaching and learning processes facilitating a great variety of learning methodologies, communication tools and learning resources. The most important aspect in virtual learning environments is that they allow establishing relations between the five basic elements that constitute the learning community: students, lecturers, learning resources, the environment, and communication tools. All these resources allow us to approach collaborative group learning processes and, as stated by De Wever et al. (2006), current learning processes show a greater adoption of tools to promote virtual collaboration.

Focusing on communication tools, one of the elements that is of increasing importance in virtual environments are the forums, and their usage in higher education as a collaborative methodology for knowledge build-up and exchange is increasingly common. Social interaction is very

important for the efficacy of collaborative learning (Kreijns, Kirschner, & Jochems, 2003). Asynchronous interaction in virtual forums enables messages between lecturers and students and between students themselves to be visible to all participants, so that all can benefit from the comments, questions and answers the debates generate (Driscoll & Carliner, 2005). In this way, educators and students can share knowledge, make progress in their individual work, work in groups, exchange information, carry self-assessments to asses at which point of the learning process each student is, etc. As Schellens & Valcke (2005) state, virtual forums ease the collaborative construction of knowledge and, additionally, participation in these collaborative processes has numerous advantages, such as improving problem solving and critical thinking skills (Neo, 2003; Schellens, Van Keer, De Wever, & Valcke, 2009) and the use of adequate cognitive strategies in each learning situation (Salovaara, 2005).

However, there are times when information and knowledge shared in the forums lack fundament and organization, and the learning objectives are not totally fulfilled. When the shared information is confusing, the discourse thread is broken and communication is interrupted. One of the elements that may boost discursive coherence and ultimately increase the quality of learning is the application of helpers or scaffolds (Rienties et al., 2012). Consequently, this research is based on collaborative learning processes using scaffolds. In particular, we aimed to analyse if there are any significant differences in students' results after following the same learning instructions for participating in a virtual forum in two different subjects. We also aimed to analyse whether the self-categorization of messages by participants really matches message content and if students have followed real metacognitive processes. We analysed and compared two virtual forums from two subjects taught at the University of ----- (----) conducted in the Sakai CLE A total of 104 students participated in the forums sending a total of 221 messages to the forums. Messages and participation were analysed quantitatively.

2 Theoretical framework

2.1 Collaborative learning through ICT usage

Collaborative learning is a process of knowledge internalization that emphasizes the exchange of information between students and the collaborative efforts established among themselves and between them and the lecturers (Hiltz & Turoff, 1993), as a result of active participation. Knowledge is seen as a social construct and the learning process is

favoured by environmental relations that facilitate interaction, evaluation, and peer cooperation. One of the methods to increase and boost learning and teaching in virtual processes is collaborative group work (Piezon & Donaldson, 2005). Moreover, group work favours problem solving activities (Black, 2002). Collaborative learning implies that students share tasks, develop responsibilities while they are performing collaborative activities, and exchange information to share knowledge. This learning generated through shared tasks contributes to improving individual learning processes. According to Scardamalia (2004), it is very important for each student to become responsible and control learning in the knowledge build-up processes. Additionally, he or she must be conscious that, while learning, he or she is incorporating new ideas and concepts and has to adopt an active role. When collaborative learning takes place using ICT resources, we can speak about Computer-Supported Collaborative Learning (CSCL). According to Van Drie et al. (2006), CSCL is defined as: a learning environment that allows easy access to information and in which individuals can share knowledge and/or build knowledge through communication and interactivity. Within the collaborative environments there is a forum tool which is an asynchronous communication tool that enables participants to exchange and share information, opinions, and knowledge.

The positive aspects contributed by collaborative learning are numerous and go beyond the academic plane, as it also foments social and emotional processes (Chou & Min, 2009). Sing & Khine (2006) reinforce the importance of establishing good interaction between members of the learning group, stating that interaction amongst students is “the key mediator” for the co-construction of shared perspectives and the internalization of cognitive strategies. Stefanone & Gay (2008) state that there is a significant relationship between the structure of the existing social network and the emerging communicative patterns, meaning that existing relationships have a strong influence on computer-mediated communication. A study by Kollias et al. (2010) showed that both teachers and students had positive attitudes towards the ICT resources and teachers agreed that students had accomplished their learning objectives satisfactorily.

It must be taken into account that, in this change of methodology where subjects interact with their peers and with the lecturer, evaluation needs to be individual and collective. Further to communication and information exchange factors, as well as social aspects, individual aspects require contemplating. The evaluation process must be designed so that

interactions are fruitful in a way that helps lecturers regulate interactive processes by students.

2.2 The scaffolds

The concept of helpers or scaffolds derives from the social constructivist-learning model (Vygotsky, 1978). According to Vygotsky's zone of proximal development, helpers should provide the right information needed at the time for students to progress in their learning. Helpers are designed and created to structure student discourse, and they help students focus on aspects of their knowledge build-up process while they are exchanging information and working with the same procedures as scientists do. As Scardamalia (2004) affirms, helpers encourage students' critical thinking, and Rienties et al., (2012) add that they have a marked effect on the amount and quality of learning.

Categorizing the messages that each person writes helps to improve the communication process and the discourse generated in the forum (Scardamalia & Bereiter, 1993; Scardamalia, 2004). They help the sender to reflect on what he or she is really doing and it is really helpful to the receiver to find messages categorized by a tag label because it allows inferring which information the note concerns.

By way of example, Hakkarainen (2004); Rahikainen, Lallimo & Hakkarainen (2001); Salovaara & Järvelä (2003) and Salovaara (2005) have completed their studies claiming that indeed students increased the usage of advanced cognitive strategies as a result of cognitive discourse and a methodology based on scientific method. Salovaara (2005) concludes that scientific methodology increases the use of cognitive strategies that promote learning.

Besides, research such as that carried out by Cacciamani & Ferrini (2007); and Russell & Perris (2003) shows that both participation and interaction between participants improve when students communicate with their peers in a collaborative learning environment and using this kind of discourse improvement helpers.

Veermans & Cesareni (2005) conclude that one of the objectives of incorporating helpers in learning processes is to further deepen in the discovery learning method.

3 Methodology

The research question focuses on whether students' results are similar or not as a result of participating in virtual forums carried out in two different subjects with the same learning instructions and using scaffolds. We also aim to study the mediator's role and the metacognitive process. It is hypothesized that learning results will be similar and that those students who have used the scaffolds properly will obtain a higher final grade. We have studied quantitative parameters such as the number of messages per day. We have also analysed message content by applying verbal analysis because as Chi (1997:2) states, *quantitative methods offer objectivity and replicability.* Students of two subjects, whose characteristics we set out in detail later, participated in the forums using a message categorization system. Once the debates were closed, lecturers analysed the messages to check whether they really corresponded to the assigned categories. In line with Rahikainen, Lallimo & Hakkarainen (2001), each message was categorized considering that it can contain several ideas and thus potentially belong to several categories. Personal implication and regularity of participation were also taken into account and consideration. Finally, we computed results as means and rates, similarly to Prinsen, Volman, & Terwel (2007). Thus, as a measure of central tendency we use the mean and as a measure of statistical dispersion, the standard deviation. Furthermore, in order to observe the degree of relationship between the grades obtained by students in the forums and the final subject grades, we use the Pearson correlation coefficient.

3.1 Main goals

This article focuses on studying whether the use of scaffolds in participants' own messages favours the quality of discourse and subsequently improves students' learning processes. In particular, we aim to study if there are significant differences in students' results after following the same learning instructions for participating in a virtual forum in two different subjects. Although the subjects are from different degrees, they have common aspects such as: the virtual environment, the methodology, the age range of students and the lecturers' teaching and learning targets. Thus, if learning results are similar, the same learning situations and processes may be applicable in subjects of different degrees. In addition, the mediator's role is also one of our study targets. We also aim to analyse whether the self-categorization of messages by participants really matches message content.

3.2 Work contextualization

This work has been carried out using the virtual forums of two different subjects taught at the (----). One of the subjects is *Organización y Gestión de Empresas de Intermediación* (Organization and Management of Intermediation Companies), a mandatory subject delivered in the second semester of the second year of Tourism Studies at the (----). The department responsible for the subject is Business Administration and Economic Management of Natural Resources. The online debate took place from 6 March to 20 March, 2013 and the main topic was "*How the Internet has changed the tourism sector and, more specifically, tourism intermediation companies*". The subject spans a whole semester, with a teaching load of 6 ECTS (European Credit Transfer System), meaning that students are expected to complete 150 study hours (60 hours in lessons and 90 hours of self-study).

The other subject is *Aprendizaje y desarrollo de la personalidad* (Learning and personality development), a year-long subject split into two semesters. Its 12 ECTS are split between 40% of classwork and 60% of study, of which 32% is individual work and 28% group work. It is a compulsory subject for students of Primary Education at the (----). The department responsible for the subject is Psychology and Pedagogy. The debate topic was "Intrinsic and Extrinsic Motivation", and it took place from 19 April to 3 May, 2013. In both cases, debates are just one of many learning activities, and they account for 10% of the final grade.

There are several reasons behind our decision to use these two entirely different subjects in our comparison. Firstly, we aimed to study if virtual forum activities were similar in these two subjects belonging to two new degrees. New teaching and learning methodologies, in line with the Bologna Process, focus on collaborative knowledge building, and our goal was to study how groups of students from two different degrees worked and communicated in collaboration with each other. Secondly, as the number of students of one subject is half that of the other, we also aimed to observe if the number of students conditioned the results of the collaborative virtual forum activities. Finally, it should to be taken into consideration that, although the topics of both forums are different, the virtual environment and the methodology are the same; students of both subjects fell within a similar age range and lecturers had the same teaching and learning targets.

Therefore, although the subjects fell into clearly differentiated knowledge fields and degrees and debate topics were quite different between the two, the guidelines and instructions for participation in and the evaluation of virtual forums were exactly the same (see appendix). The

objectives of the forum activity were as follows: for students to increase their knowledge in relation to the debate topic; for them all to contribute to improving their learning collectively; for them to learn to argue and reason on the proposed topic, using the provided bibliographic references and other complementary references; and for them to learn to use and get used to the virtual forum tool of the virtual campus in use at the (----). For the preparation of the guidelines and instructions, both lecturers met and after sharing the teaching targets of the each subject, we decided to study whether when applying the same instructions in a virtual forum assignment the students of two different subjects would learn collaboratively in a similar way. Then we drafted the instructions according to the learning goals.

The virtual environment used for both virtual forums, Sakai CLE v2.7, is a learning management tool in use at the (----) since 2004. Sakai provides several tools that let instructors provide students with documents and resources, structure the subject syllabus, carry out evaluation activities (such as homework, projects, test assessments, and self-assessment activities), while also providing communication tools: private messaging (both between students and between students and instructors), forums, chats, calendar, announcements, and a shared drop box. The virtual forum tool allows students to create both new message threads as well as answer existing message threads. Messages can be organized by topics and the instructors decide whether students can create new topics.

3.3 ***Sample***

The number of students participating in the two forums was 104, 36 from the Tourism subject. Of those 36: seven, 19.4%, did not participate in the forums, so their grade was Non Qualified; three, 8.3%, wrote less than three messages, the required minimum to be graded, so their grade was zero; three, 8.3%, obtained poor grades (less than 5/10); seven, 19.4%, achieved an average grade (5 to 6.9); and 16, 44.4%, got a high grade (7 or more). In the Primary education subject, out of the 68 enrolled students, 23, 33.8%, did not participate in the forums, so their grade was Non Qualified; 17, 25%, got obtained poor grades (less than 5/ 10); 10, 14.7%, achieved a medium grade (5 to 6.9); and 18, 26.4%, got a high grade (7 or more). The average age was 21.64 and 76% were female and 24% male.

3.4 Virtual forum experiences

In the case of the Tourism degree subject, debate instructions were published on the virtual campus a few days before the starting date for the debate and, on the starting date, during regular class hours, they were presented to students and any issues and questions were addressed. In the Primary education degree subject, instructions were published on the starting date and were also exposed to students during regular class hours. In both cases, during the presentation of the activity the instructors stressed the importance of classifying all sent messages into some of the categories even to the point of stating that failing to categorize a message would result in that message not being taken into consideration for the purposes of grading. The categories or scaffolds were well explained and discussed in the classroom before the forum started. Both lecturers made sure that every student clearly understood the categories. The categories are explained in the data analysis section. Most of the participating students already had experience in virtual forums because, in previous semesters, other subjects had already included similar activities.

3.5 Data collection

The data were collected over a period of a semester. The content of the forum messages was collected in text files. All selected forums were analysed following quantitative parameters and verbal analysis.

3.6 Data analysis

Firstly, all selected forums were analysed following quantitative parameters (number of participants, total number of messages, and number of messages per day). Secondly, we analysed message content by using verbal analysis. According to Chi (1997:2), *verbal analysis is a methodology for quantifying the subjective or qualitative coding of the contents of verbal utterances. In verbal analysis, one tabulates, counts, and draws relations between the occurrences of different kinds of utterances to reduce the subjectiveness of qualitative coding*.
We have used three types of categories set up previously by both lecturers. We took into consideration the learning goals that students should reach after the collaborative learning process and we decided that these three scaffolds (Opinion, Different Opinion and Elaboration) were suitable to be applied. After reviewing different studies concerning this topic, we decided to consider the 'idea' as the unit of analysis, following authors such as Salovaara (2005), Strijbos, Martens, Prins, and Jochems (2006) and De Smet et al. (2008). The reasons behind our choice are that, on the

one hand, there can be several categories of analysis in each message and, on the other hand, an 'idea' can be formulated in different sentences. This analysis of messages written by students has been conducted using a coding scheme based on the social cycle processes of the model of collaborative knowledge building (Stahl, 2000) (Table 1). The categories used to analyse message content for both forums were the same that students had to use to label their own messages.

OPINION	Messages stating a personal opinion or personal experience- based opinion.
DIFFERENT OPINION	Messages arguing a different opinion to that contained in previous messages by other students.
ELABORATION	Messages stating example- or evidence-based ideas (indicating the relevant bibliographic references and sources).

Table 1: A coding scheme partially based on the social knowledge cycle (Stahl, 2000)

4 Results

To analyse the results, on the one hand we performed a quantitative analysis (the number of messages sent and interaction graphs); and on the other hand verbal analysis of message categories.

4.1 Quantitative parameters

Results show that there were more messages in the Tourism forum, 113 compared to the 108 sent to the Primary education forum. When the number of students of each group is taken into consideration, we can observe that Tourism students sent a mean of 3.14 messages (SD 2.15), compared to just 1.59 (SD 1.36) by Primary education students.

4.1.1 Message volumes sent during two weeks

During the fortnight in which the debate took place in both forums, messages were sent according to the following distribution:

	Day 1	*Day 2*	*Day 3*	*Day 4*	*Day 5*	*Day 6*	*Day 7*	*Day 8*	*Day 9*	*Day 10*	*Day 11*	*Day 12*	*Day 13*	*Day 14*	*Day 15*

Tourism subject	0	2	7	6	8	6	4	3	12	11	11	6	6	16	15
Primary education subject	0	3	1	4	4	9	4	3	7	3	12	9	12	23	14

Table 2: Daily messages by students by subject

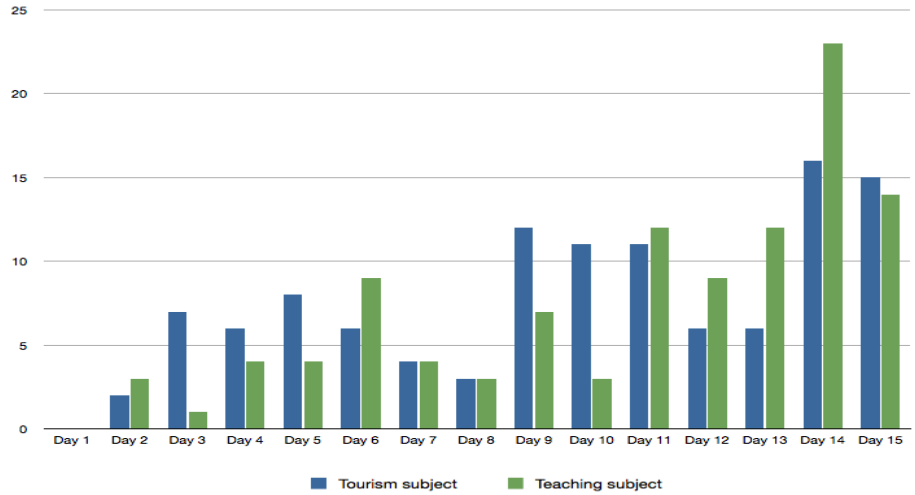

Chart 1: Daily interventions by students by subject

In the Tourism subject, most messages were posted during the second week of the debate. Of the 113 messages sent, 36 (31.9%) were sent during the first week, while 77 (68.1%) were sent during the second week.

An average of 8.07 messages were sent each weekday, Monday to Friday, with an average of 8.2 messages/day, while during weekends the average fell to 7.75 daily messages.

Likewise, in the Primary education subject, messages were mostly sent during the second and final week of the debate. Of the 108 messages sent, 25 (23.1%) were sent in the first week, compared to 83 (76.8%) sent during the second week.

The daily average was 7.2 messages, with a workday (Monday to Friday) average standing at 8.55 messages and a greatly reduced average at weekends, to just 3.5 daily messages. Lecturers intervened by asking questions and opening discussion threads on the following days:

	Day 1	*Day 2*	*Day 3*	*Day 4*	*Day 5*	*Day 6*	*Day 7*	*Day 8*	*Day 9*	*Day 10*	*Day 11*	*Day 12*	*Day 13*	*Day 14*	*Day 15*
Tourism subject		1		1	1				1	1		1		1	
Primary education subject	1							1			1	1		1	

Table 3: Daily interventions by lecturers

The Tourism lecturer also intervened a further eight times in the debate, notably to close debate threads that had already been overcommented and to clarify some issues.

The result of quantitative analysis shows that, usually, students delayed their participation to the last available days. In both subjects, the most intense day of the debate was the second to last day.

Next we show the graphs corresponding to each subject. We have created a graph for each debate to observe interrelationships and communication patterns established amongst participants. A graph is a chart generated by the interrelationships taken place in a virtual forum and where each node is a participant whose identity is shown by the number label attached to each node. This way, the lecturer-mediator of the forum can know the sociogram created between participants. Graphs show the response messages in the forums. Contributions related to the original message are not shown in the graph because they are not a response to any message, their content instead referring to new parts of the communication or knowledge build-up.

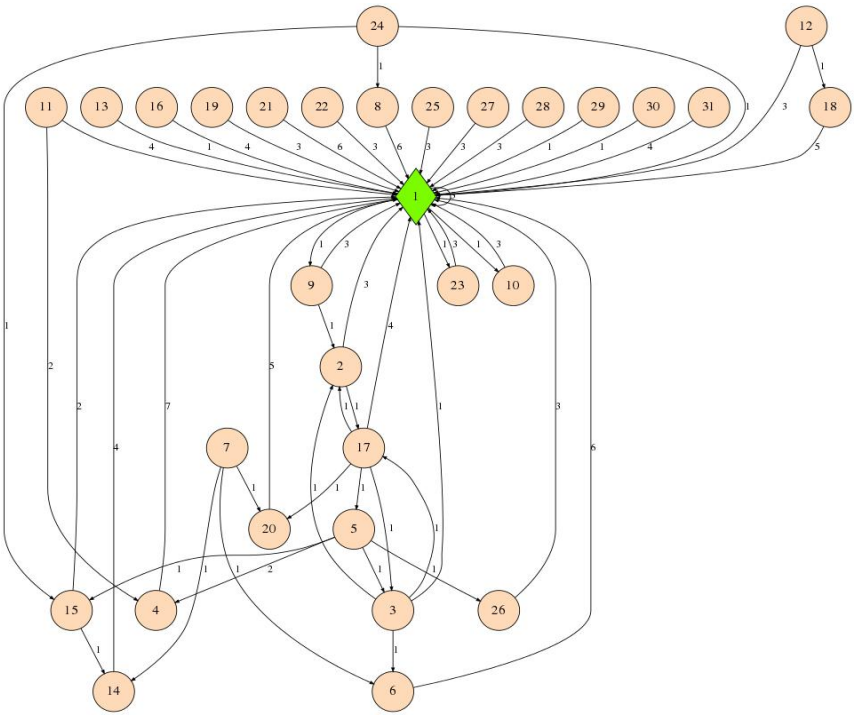

Figure 1: Interaction graph of the Tourism subject

The graph in figure 1 shows the interaction network established in the Tourism subject forum. The lecturer is node 1 and receives most messages. It is worth highlighting node 17, who has written 8 messages and who, a priori, seems to be a communicative connection point receiving messages from and answering some of the other students. It is also worth noting that node 17 was a student from a mobility programme that did not have any previous experience either in the usage of the virtual forum or in the virtual campus Sakai CLE, leading him to post most messages as well as answers to other messages; however, message content in most cases did not refer to questions posed by the other students.

This behaviour is in contrast, for instance, with that of node 4, who has written seven messages, all directed exclusively to the lecturer. It seems that this behaviour is exhibited by most participants: a high number of nodes, such as 8, 13, 16, 19, 21, 22, 25 and 27, only answer directly to the lecturer. That said, all nodes but one, number 7, did write answers to the lecturer. That participant, number 7, wrote three reply messages, all of them to different students.

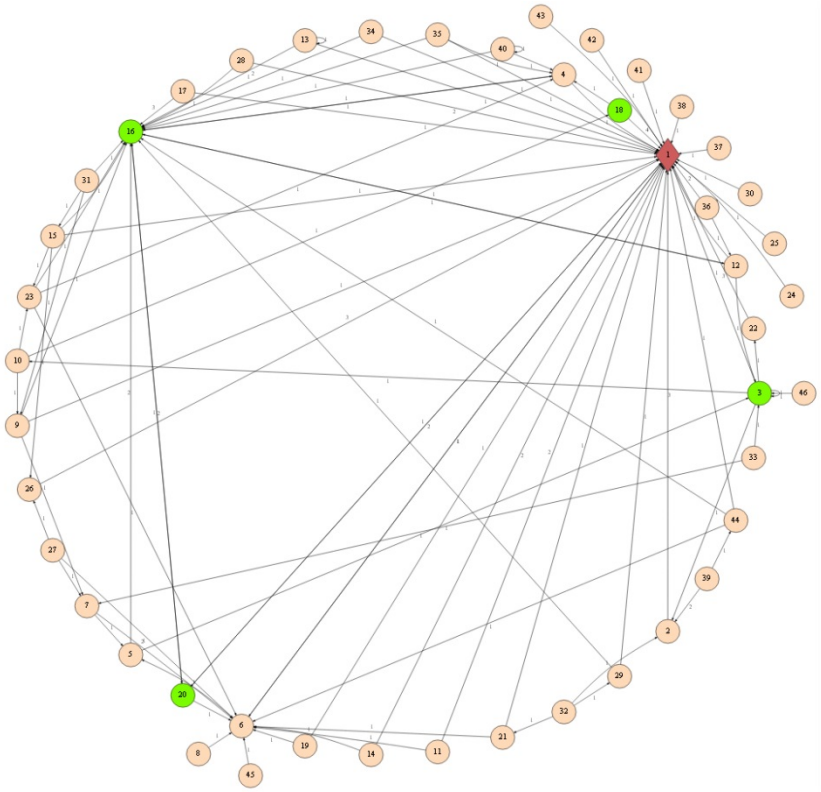

Figure 2: Interaction graph of the Primary education subject.

We can observe the interactions established in the Primary education subject forum in the graph in Figure 2. As can be seen, there is a chain-like structure of consecutive messages between participants, excluding participants that only contributed to the original message. However, they are all are connected in one way or another, be it through response messages sent or through other students' answers to their message. Node number 1 is the lecturer and, as we can observe, most messages are responses to her, similarly to what is seen in the other forum. Then four green nodes, 3, 16, 18 and 20, are the four students with most messages, having sent five messages each. We must highlight node 6 who, despite having sent only three messages, received a feedback of 10 messages from fellow students and one from the lecturer. We can also observe that 11 participants have had interactions only with one another person, so they stand outside of the connection network in the graph. Of those 11, eight (nodes 43, 42, 41, 38, 37, 30, 25 and 24) replied only to the lecturer, two (nodes 8 and 45) to node 6, and node 46 only interacted with node 3, who is one of the four most active students.

Both graphs show that many participants have written in the lecturer's thread, which could mean that students still have the idea of answering lecturers and not of exchanging ideas, opinions and different points of view with other students. However, the interaction in the graph of figure 1 is more focused on the meditator, whereas in the other graph we can observe that there are several students who have sent and received classmates' messages.

4.1.2 Evaluation

Regarding the evaluation, as indicated above, forum activity represents 10% of the final grade in both subjects. In the Tourism subject, the average grade for forum activities was 5.19 (SD 3.69) and the average final grade for the subject was 5.68 (SD 2.01), so forum grades were lower than those obtained in other activities proposed during the semester. On the other hand, in the case of the Primary education subject, the average grade for forum activities was 4.0 (SD 3.98), while the average final subject grade was 7.02 (SD 1.60), so the forum grades were much lower than those for other activities proposed during the semester.

Furthermore, we performed a hypothesis test to measure the degree of relationship between the grades obtained by students in the forums and the final subject grades. We believe that the level of motivation and implication that students have in the virtual forum is related with the level they have in the subject in general. We aim to find out if there were any differences or not, because studies such as those by Chan & Chan (2011) find a correlation between higher-achieving students and high levels of implication in collaborative knowledge building.

In the Tourism subject, the Pearson correlation coefficient was 0.75, so we can conclude that there is a highly significant positive correlation between the grade obtained in the forums and the final subject grade. In the case of the Primary education subject, the Pearson correlation coefficient was 0.55, so the correlation is also positive, albeit slightly weaker. In both cases, both are significant, as the p-value remains below the 0.05 threshold.

4.2 Verbal analysis

For the results obtained in terms of message categorization, we can observe the following.

4.2.1 Messages

In the Tourism subject forum, during the two weeks of debate, students sent 113 messages (although 113 messages were sent, the sum of the number of messages in the three categories amounts to 131, as some messages included ideas from more than one category, as we mentioned earlier in the analysis unit description). A total of 76 messages (58%) belonged to the *Opinion* category, i.e. messages expressing a personal opinion or a personal experience-based opinion; 12 (9.2%) belonged to the *Different Opinion* category, i.e. messages presenting a different opinion to those shown by other students; and 43 (32.8%) to the *Elaboration* category, i.e. messages stating example- or evidence-based ideas indicating the relevant bibliographic references and sources.

In the Primary education subject, 108 messages were sent, but similarly to the Tourism subject forum, the sum of messages per category totals 128: 108 (84.3%) belonging to the *Opinion* category, 13 (10.1%) to the *Different Opinion* category, and seven (5.4%) to the *Elaboration* category.

4.2.2 Categorization

Regarding message categorization, in the Tourism subject forum, only nine of all sent messages were uncategorized, all belonging to the *Opinion* category, while five were incorrectly categorized –as *Elaboration* when they belonged to *Opinion*. By contrast, in the Primary education subject forum, there were up to 52 uncategorized messages, mostly belonging to the *Opinion* category. Despite this, we should also point out that 18 participants had correctly categorized other messages, both sent before and after the uncategorized one.

	Tourism subject		Primary education subject	
	Students	Lecturer	Students	Lecturer
OPINION	62	76	58	108
DIFFERENT OPINION	12	12	10	13
ELABORATION	48	43	5	7
TOTAL	122	131	73	128

Table 4: Comparison of message categorization

As can be seen in Table 4, almost all messages posted in the Tourism subject forum were categorized and, in most cases, correctly categorized. It is also worth noting that students tend to mislabel messages as belonging to the *Elaboration* category when they were in fact expressing an *Opinion*. This could be attributed to the lecturer stressing

that *Elaboration* and *Different Opinion* messages would be graded better than messages of *Opinion*, so perhaps some students categorized *Opinion* messages as *Elaboration* messages in the hope of getting better grades. As regards the Primary education subject forum, there were more students that did not categorize *Opinion* messages as such than in the Tourism forum. For example, this contribution "*I think it is as important to be logical as it is to know how to communicate with other people and know how to face up to and solve daily problems*" was labelled as *Elaboration*, but it is an *Opinion*.

5 Implications

One of the aims of this study is to analyse the use of scaffolds by students. The findings of this study indicate that concerning the typology of sent messages, *Opinion* messages were the most numerous in both cases, followed by *Elaboration* messages. *Different Opinion* messages are less common, as already observed by Jorczak & Bart (2009), who state that the percentage of disagreement expressed by participants on their research was very low (11.7%). This leads us to affirm that what students do in a forum is basically to transmit information, to give personal opinions occasionally providing examples and evidence, and more rarely to contribute with a different opinion or point of view. These results indicate that other aspects should be taken into account to optimize collaborative learning processes. For instance, as Chan & Chan (2011) point out it is necessary to be aware of how students understand collaboration when working on computer forums. *A structural equation model indicated that the students' views of collaboration exerted a direct effect on online participation in Knowledge Forum and mediated the effects of deep approaches on forum participation* (Chan & Chan, 2011, p. 1454). Also of note is the fact that, in both forums, the day involving most activity was the penultimate before the closure of the debate. These results could be influenced by the messages sent by both lecturers four days before the completion date and the fact that the participating period was close to the end. With these data, we can posit that students tend to leave work for the last moment and participate just before the deadline. However, there is a tendency to adopt a more active role in activities or projects carried out under the direct pressure of advisors or lecturers and when the deadline is near. Consequently, we should consider that working with tight schedules is not always positive and we must take into account that tasks done under pressure might not fulfil the same quality standards that those not done under pressure. Gracia, Caballer, & Peiró (2002) concluded in their study

that deadline pressure negatively affected group cohesion in intellectual and agreement tasks and, to a lesser extent, in more creative tasks.

In relation to the results obtained from the graphs, we should take into account that, although a relationship can be seen among participants, we cannot assume that a message is a response to another one just because it is created as a response, as sometimes students place their messages in the wrong places. This misplacement of messages in forums is something that must be dealt with, and before starting a virtual forum, instructors must stress to students the importance of correctly placing their contributions in discussion threads. Marcelo and Perera (2007) also observed this effect in their research and in their studies, Hewitt (2005) and Lipponen et al. (2003) observed that online discussion threads were short and fragmented. Furthermore, both graphs show that many participants have written in the lecturer's thread, which could mean that students still have the idea of answering lecturers and not of exchanging ideas, opinions and different points of view with other students.

Thus, regarding the mediator's role, the fact that messages are not categorized or that message content is incorrectly categorized is more frequent in the Primary education than in the Tourism forum. The reason behind that is that the Tourism lecturer did stress that messages should be categorized or they would not be taken into consideration when grading. Conversely, this was not stressed by the Primary education lecturer during the debate, the need to categorize only being highlighted in the written instructions. The results support this explanation, as the rate of correctly categorized messages is much higher in the Tourism subject forum than in the Primary education subject forum (93.13% and 57.03%, respectively). With this, we can conclude that it is important that the instructor should stress participation guidelines and, above all, that if the need to categorize is not required by the grading rules, the ratio of participating students falls. The fact that the instructions were available a few days before the Tourism subject forum debate took place could be a stimulus for students to categorize their messages, which did not occur in the Primary education subject forum, where instructions were only available on the very same day that the debate kicked off. This leads us to conclude that the role of the lecturer-mediator is very important, because students are more engaged in their learning and collaborative communication process if the lecturer plays an active role, overseeing students' participation and guiding the collective knowledge build-up. Stein et al. (2013, p. 82) concluded their research stating that *if a group is continuously coached and provided with feedback in teaching presence and social presence over time, group*

members may increase the frequency of higher-order cognitive presence compared to members of an un-coached group.

Another aim is to study if students follow metacognitive processes and they are conscious of what they are doing in their contributions. Thus, we analyse whether the self-categorization of messages by participants really matches message content. In general, we can observe that not all messages are correctly categorized, with students mislabelling or failing to categorize some of their messages. Veermans & Cesareni (2005) also observed in their studies that, although the analysis of message content showed that those students were involved in terms of learning processes, sometimes they did not categorize posts correctly. Cesareni & Martini (2005) also noted that students had problems using helpers in the right way. Despite the above, these authors confirmed that students that worked individually achieved less satisfactory results that those working in groups or in pairs. As can also be observed in the results of this research, there is a significant positive correlation between the grades obtained in the forums and the final grade for the subject. These results are in line with those that Chan & Chan (2011, p. 1453) observe in their study and they conclude that: *analyses of individual differences indicate that higher-achieving students obtain higher scores on deep approach and collaborative knowledge building*.

In relation to the amount of students that either did not participate in the forum or got a low grade, we observe that although information and communication technologies are used in the learning processes, there are still students who think that virtual assignments are not so important as those done face to face in the classroom. Thus, it is important for the mediator to explain beforehand to students that virtual assignments have the same importance as classroom assignments. Furthermore, the score of the forum might be higher so that students take them into consideration more seriously.

We also conclude that the instructions or scripts have to be clearly written so that students do not have any doubts concerning the rules of participation. According to Morris et al. (2010), "scripts" are instructions stating how participants must participate. The tasks that students have to perform in a virtual forum need organization, guidelines and models. Rummel, Spada & Hauser (2009) state that interactions in forums with clear instructions were of higher quality than those in forums with scarce instructions. The goals of the task and the purpose of the communication procedure must be clearly specified from the outset. Participants must know the role they are expected to play in the forum and how they will be graded. Similar conclusions are also drawn in studies done by De Wever,

Schellens, Van Keer, & Valcke (2009); Dillenbourg & Tchounikine (2007) and Weinberger, Ertl, Fischer, & Mandl (2005).

6 Conclusions

The main goal of this research is to study if there are any significant differences in students' results after following the same learning instructions for participating in a virtual forum in two different subjects. According to the results obtained, we can conclude that no matter how different a subject is from another, what is really important is that there are well-designed methodologies and instructions for participation, that the mediator's participation improves students' interactions and their involvement and that students contribute conscious of what they are writing and sharing. Therefore, in the group knowledge creation processes, the importance of the role played by the mediator-instructor must be taken into account to optimize information exchange and communication between group members. It is important for the mediator to help remedy group problems and issues and manage coordination (Hron & Friedrich, 2003). Our results are also in line with those of Lee (2008), who showed that the role of the mediator-lecturer was critical in the teaching and learning processes as well as in communication between members of the learning community.

We conclude that forum instructions of utmost importance, and perhaps if a lecturer points out clearly what a virtual forum actually is, and students have more experience sharing virtual contributions, then interactions will be more student-focused. The lecturer's role should be one of a mediator and students should communicate among themselves more freely and without the feeling that a lecturer is evaluating them all the time. Thus, the mediator's participation is very important but ensuring that students feel free enough to contribute without the pressure of writing information simply to prove to the lecturer that they know the content. Future research work should consider this finding to promote more fluent communication among participants.

To sum up, we conclude that there are multiple factors to be taken into consideration for forum activity to be positive. On the one hand, the role of the mediator must be taken care of, and that role must be active throughout the activity. On the other hand, participants must properly employ the words used to categorize messages (scaffolds), they must understand them and, if necessary, the possibility of creating a test forum so that students can become familiar with them could be considered.

Scaffolds are very important to help students become aware of the kind of contributions they make, as also confirmed by Scardamalia (2004). Furthermore, students must be aware of the importance of placing messages in the correct place in conversation threads. Usually, students whose participation in the forum was positive, as shown by the correlation results (0.75 and 0.55 respectively), also obtained high final grades in the subjects. Given the above, we can conclude that personal motivation and the predisposition to carry out activities and to actively contribute are in line with the rest of the tasks. We consider that, in all virtual forum activities, these factors must be taken into account and also student contributions should be encouraged to propose different points of view, as well as increased information and knowledge exchange amongst participants.

The results point us towards future research in order to optimize virtual and collaborative learning processes. We can state that when the same forum patters (methodology, virtual environment and learning instructions) are applied in two different learning situations (two different subjects), results are similar. Hence, we can conclude that the same learning patterns are replicated within the domain of the second subject. Means, Toyama, Murphy, Bakia & Jones (2009) also concluded in their review that there were no differences associated with the nature of the subject matter involved. In future work we will focus on the factors that contribute to the optimization of communication and on the interaction networks established among participants in virtual forums. Consequently, future research could encompass the study of students' motivation to contribute with deeper cognitive messages, so that they are aware of what they are learning in their collaborative processes. We also consider the lecturers' role, instructions (scripts) and methodology as crucial factors for analysis and in-depth study in order to optimize virtual and collaborative learning processes.

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7 Appendix

Rules for participating in the debate:

1) The debate will take place on the virtual campus in the Debate space of the subject Organization and Management of Intermediary Companies.
2) The debate has a moderator who is responsible forinitiating and closing the topic, and if necessary, will resolve doubts.
3) You must send a minimum of three messages in total. Your involvement should take place in different weeks.
4) It is important to put the messages in the right place: If you start a new topic of conversation, you will be sending a new message, whereas if you are answering an earlier post, you will follow the thread of the conversation.
5) All messages should be labelled at the beginning of the message, if there are no labels, the message will not be counted as sent.
   - **OPINION**
     Messages stating a personal opinion or a personal experience-based opinion.
   - **DIFFERENT OPINION**
     Messages arguing a different opinion to previous messages by other students giving their opinion.
   - **ELABORATION**

Messages stating example or evidence-based ideas (indicating the bibliographic references and sources).

Rules for sending a message:

1) No need for needless farewell formulas used in each message you send to the debate.
2) Respect the other participants in the debate. You can disagree with the ideas and opinions of others, but always with respect and courtesy.
3) Do not write messages that say, 'I agree (or disagree) with X'. In any case, state why you agree (or why not), and refer previously to the idea that you want to refute or expand.
4) Each message sent to the debate must contribute something new, for or against the ideas expressed, or open new, never repeated areas of discussion.
5) Messages can only be sent if they are related with the topic.
6) The messages must be short (maximum ten lines).
7) When intervening in favour or against the ideas expressed, it must not have been too long because it is difficult to follow the discussion.
8) The messages can be sent in Catalan, Spanish and English. They must be clear, concise, correct and without spelling or grammatical mistakes.

Evaluation criteria:

Comply with the debate rules. (Prerequisite, if not it will be marked as not submitted).

IStudent involvement in the debate with message content will be scored at 80%. From least to most:

- **OPINION**
  Messages stating a personal opinion or a personal experience-based opinion.
- **DIFFERENT OPINION**
  Messages arguing a different opinion to previous messages by other students giving their opinion.
- **ELABORATION**
  Messages stating example or evidence-based ideas (indicating the bibliographic references and sources).

Regularity in the debate will be scored at 20% and will measure:

- Interventions at different times during the two-week duration of the debate.
- Not leaving messages only for the beginning and/or end of the debate.